I.C.M. EXPERIMENTS WITH WINTER AND SPRING WHEATS IN SASKATCHEWAN, 1985

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INTRODUCTION

Intensive Cereal Management refers to a cropping system to remove every limitation to yield through the application of an array of crop production inputs. Many European farmers have adopted such an approach, which involves an optimal integration of:

1. A variety with a high yield potential under highly favorable growing conditions;
2. Seeding rate, date, and depth;
3. High fertilizer levels in split applications, including micronutrients as needed;
4. Plant growth regulators to control lodging;
5. Herbicides for near complete weed control;
6. Fungicides for near complete disease control;
7. Insecticides for near complete insect control.

Despite the much lower precipitation and shorter growing season in Saskatchewan, the industry has expressed much interest in the potential adaptability of these practices modified for Saskatchewan conditions. As a result, a fairly large research project on wheat was initiated by the University of Saskatchewan in 1985. The use of higher than usual nitrogen fertilizer rates, plant growth regulators, and fungicides in different combinations was tested. The objective of this paper is to present a summary of results from winter wheat, hard red spring wheat and HY320.

MATERIALS AND METHODS

Locations

Sites were established on good early season stands of farmer-sown Norstar winter wheat at Outlook, Elrose, and Shellbrook; and Katepwa or Columbus hard red spring wheat, and HY320 spring wheat, at Outlook, Elrose, Saskatoon, and Birch Hills. All Outlook sites were irrigated.

Treatments

In addition to farmer-applied fertilizer, nitrogen as ammonium nitrate (34-0-0) was broadcast postemergently at rates of 0, 56 and 112 kg/ha, the latter in split application 3-4 weeks apart.

The fungicide Bayleton[1] was applied at 250 g/ha to the extended flag leaf (Zadoks Growth Stage 37-45), and Tilt[2] was applied at 500 ml/ha, at the same stage.

The growth regulating chemical Cycocel Extra[3] was applied at the detection of the first node on the primary tiller (Growth Stage 31), at 2.5 l/ha; and Terpal C[4] was applied between the detection of the second node and appearance of the flag leaf collar (Growth Stage 32-37), at the same rate.

At the Saskatoon site, Cycocel Extra rates of 1.0, 1.5, and 2.0 l/ha; Terpal C at 1.0, 1.25, and 2.0 l/ha; and Terpal[4] at 1.0, 1.25 and 2.0 l/ha were applied.

[1] Bayleton is a registered trademark of Bayer AG, Chemagro Limited is the user.

[2] Tilt is a registered trademark of Ciba-Geigy Canada Ltd.

[3] Cycocel Extra is a registered trademark of Cyanamid of Canada Ltd. BASF is the user.

[4] Terpal C, Terpal are registered trademarks of BASF.

Fungicide and growth regulators were applied through 80° Tee-jets in 220 l of water per ha. Both were compared to check (no application) plots. The nitrogen, fungicide and growth regulator treatments were applied in all combinations, with three replications per site.

Yield determination

Yields were obtained from a 7.5 m cut with a 1.25 m Hege plot harvester, and converted to an equal moisture basis.

RESULTS AND DISCUSSION

The following tables present the mean yield, height and lodging effects of the various N, fungicide and growth regulator treatments at each site. There were no significant interactions in yield resulting from any combination of these factors at any location.

Table 1. Effect of N, fungicides and growth regulators on Norstar Winter Wheat at Outlook, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	5090 b	75 a
56 kg N/ha	5460 ab	81 b
112 kg N/ha	5800 a	84 b
No Fungicide	5580	80
Bayleton	5290	78
Tilt	5610	80
No Regulator	5040 b	83 b
Cycocel	5810 a	79 a
Terpal C	5500 ab	77 a
Mean	5450	80

There were significant responses to N and to the growth regulator Cycocel in the Winter Wheat experiment at Outlook. Initial soil N was 15 kg/ha, but the field was fertigated with about 45 kg N/ha.

There were significant effects of both N and growth regulators on height, with Terpal C reducing height by 6 cm and Cycocel by 4 cm.

Table 2. Effect of N, fungicides and growth regulators on Norstar Winter Wheat at Elrose, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	1310	60
56 kg N/ha	1300	61
112 kg N/ha	1460	61
No Fungicide	1220	59
Bayleton	1510	61
Tilt	1220	61
No Regulator	1290	64 b
Cycocel	1370	64 b
Terpal C	1400	54 a
Mean	1350	60

There were no significant yield responses to any treatment at Elrose. The soil test indicated 63 kg N/ha in the spring, apparently adequate for the poor moisture conditions. Terpal C significantly reduced the height by 10 cm.

Table 3. Effect of N, fungicides and growth regulators on Norstar winter wheat at Shellbrook, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	4420	88
56 kg N/ha	4600	89
112 kg N/ha	4730	89
No Fungicide	4400 b	88
Bayleton	5140 a	94
Tilt	4300 b	85
No Regulator	4350	95 b
Cycocel	4640	93 b
Terpal C	4760	78 a
Mean	4580	89

At Shellbrook, the spring soil test indicated only 39 kg N/ha, yet neither N nor growth regulators affected yield. Substantial N release during the growing season could account for the high yield of unfertilized check plots.

The fungicide Bayleton significantly increased yield to an economically feasible extent. Powdery mildew was present on lower stems and leaves at heading time.

Terpal C reduced plant height by 17 cm.

There was no lodging at any of the winter wheat sites.

Table 4. Effect of N, fungicides and growth regulators on Katepwa HRS wheat at Outlook, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm	Lodging, 0-5*
ON	4980	99	1.1 a
56 kg N/ha	4660	102	2.4 ab
112 kg N/ha	4770	101	2.6 b
No Fungicide	4680	102	1.8
Bayleton	4780	100	2.1
Tilt	4910	100	2.1
2X Tilt	4840	101	2.0
No Regulator	4750	109 c	3.1 b
Cycocel	4740	105 b	2.5 b
Terpal C	4910	88 a	0.5 a
Mean	4810	101	2.0

*0=no lodging, 5=complete lodging

The spring soil test on the Outlook Katepwa site indicated 181 kg/ha present, which was adequate for the yield obtained. There were no significant effects of any treatment on yield, but height was reduced by 4 and 21 cm with Cycocel and Terpal C, respectively. A high positive correlation existed between plant height and lodging, with r=0.56. N, growth regulators and their highly significant interaction affected lodging, with Terpal C and no additional N providing the least lodging.

Table 5. Effect of N, fungicides and growth regulators on Columbus HRS wheat at Elrose, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	2310	64
56 kg N/ha	2280	63
112 kg N/ha	2240	63
No Fungicide	2300	64
Bayleton	2230	64
Tilt	2290	63
2x Tilt	2280	63
No Regulator	2280	65 b
Cycocel	2220	66 b
Terpal C	2330	59 a
Mean	2280	64

The spring soil test at the Elrose Columbus site indicated 67 kg N/ha, which was adequate considering the dry growing conditions. There were no significant effects of any treatment on yield at this site, but there was a 6 cm reduction in height from Terpal C.

Table 6. Effect of N, fungicides and growth regulators on Katepwa HRS wheat at Birch Hills, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	3960 b	71
56 kg N/ha	4270 a	74
112 kg N/ha	4190 ab	73
No Fungicide	4240	72
Bayleton	4010	73
Tilt	4060	73
2x Tilt	4260	73
No Regulator	4190 a	83 c
Cycocel	4300 a	75 b
Terpal C	3940 b	59 a
Mean	4140	73

A spring soil test at the Birch Hills Katepwa site indicated 115 kg N/ha. The crop responded to the low N application, and Cycocel and Terpal C reduced the height by an average of 8 and 24 cm respectively.

Table 7. Effect of N, fungicides and growth regulators on Katepwa HRS wheat at Saskatoon, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	3360 b	73
56 kg N/ha	3630 a	73
112 kg N/ha	3630 a	73
No Fungicide	3570	73
Bayleton	3500	73
Tilt	3550	73
No Regulator	3430	75 bc
Cycocel 1.0 l/ha	3530	74 bc
1.5 l/ha	3420	73 b
2.0 l/ha	3720	75 bc
Terpal 1.0 l/ha	3390	76 c
1.25 l/ha	3520	70 a
2.0 l/ha	3660	73 b
Terpal C 1.0 l/ha	3440	71 ab
1.25 l/ha	3650	74 bc
2.0 l/ha	3650	71 ab
Mean	3540	73

Spring soil tests indicated the presence of about 65 kg N/ha on the Saskatoon-Katepwa site. There was a significant yield response to the first 56 kg of N. The rate response of Cycocel, Terpal and Terpal C lacks clarity, but the Terpal and Terpal C did, in general, reduce height marginally.

Table 8. Effect of N, fungicides and growth regulators on HY320 spring wheat at Outlook, Sask.

Treatment	Wheat yield, kg/ha	height, cm	Lodging, 1-5*
ON	5900 a	84	2.2
56 kg N/ha	5430 ab	84	2.5
112 kg N/ha	5060 b	82	3.1
No Fungicide	5280	84 b	2.8
Bayleton	5230	83 ab	2.5
Tilt	5550	81 a	2.7
2x Tilt	5800	85 b	2.4
No Regulator	5410	87 b	3.2 b
Cycocel	5290	86 b	3.3 b
Terpal C	5690	76 a	1.4 a
Mean	5460	83	2.6

*1=no lodging, 5=complete lodging

There was a significant negative response to N, on the Outlook HY320, likely because of heavy lodging. Spring soil tests indicated 168 kg N/ha.

Height was reduced 11 cm with Terpal C, and Tilt exhibited some height reduction as well. Terpal C caused a highly significant reduction in lodging, which was highly correlated with height, r=0.67.

Table 9. Effect of N, fungicides and growth regulators on HY320 Spring Wheat at Birch Hills, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	5680	72
56 kg N/ha	5890	72
112 kg N/ha	5740	70
No Fungicide	5500	71
Bayleton	5870	72
Tilt	5790	71
2x Tilt	5910	71
No Regulator	5830 a	77 c
Cycocel	6070 a	72 b
Terpal C	5410 b	65 a
Mean	5770	71

The soil test for the HY320 site at Birch Hills indicated 115 kg N/ha, and additional N gave no yield response. Terpal C depressed yield, while reducing height by 12 cm. Cycocel treated plots averaged 5 cm shorter than the check, but did not depress yield.

Table 10. Effect of N, fungicides and growth regulators on HY320 spring wheat at Saskatoon, Sask.

Treatment	Wheat yield, kg/ha	Plant height, cm
ON	4300 b	61
56 kg N/ha	4620 a	60
112 kg N/ha	4560 a	59
No Fungicide	4510	60
Bayleton	4480	60
Tilt	4480	60
No Regulator	4550	62 b
Cycocel 1.0 l/ha	4470	61 b
1.5 l/ha	4580	62 b
2.0 l/ha	4670	60 ab
Terpal 1.0 l/ha	4590	60 ab
1.25 l/ha	4510	60 ab
2.0 l/ha	4220	58 a
Terpal C 1.0 l/ha	4850	61 b
1.25 l/ha	4220	58 a
2.0 l/ha	4260	58 a
Mean	4490	60 ab

Spring soil tests indicated about 65 kg N/ha on the Saskatoon HY320 site. A yield response was evident from the lower rate of N fertilizer. While rate effects on height are not clear, both Terpal and Terpal C reduced plant height to a small extent.

An HY320 experiment was laid out and treatments applied on schedule at Elrose, Sask. Because of severe drought it was abandoned before harvest time.

General Observations and Comments

Cycocel's effect on plant height is more complex than first appears. The early culms were shortened drastically, but a later growth of tillers was about the same height as the check plots. With a long growing season and adequate moisture late in the growing season, such a growth pattern might enhance yield.

Both plant growth regulators delayed maturity by several days at most of the sites. This was especially evident with the Norstar winter wheat.

The growth regulator Terpal C significantly decreased kernel weight at a number of sites (data not shown). Since this may lead to a quality reduction and there was no enhancement of yield, the net economic return to the regulator could be quite negative in the absence of lodging.

SUMMARY

No yield interactions between growth regulators, nitrogen or fungicides occurred in any of 10 tests. Five of ten tests had a positive yield response to more N, and one site exhibited a yield increase from the fungicide Bayleton. The growth regulator Cycocel Extra increased yield at one site, while Terpal C reduced yield at 2 sites.

Terpal C reduced plant height at all sites, while Cycocel reduced height at 4 sites and Terpal at 1 of 2 sites. Nitrogen increased the height at only one site.

Lodging, which was highly correlated with height, occurred only on the two spring wheat varieties at Outlook, under irrigation. Terpal C significantly reduced lodging on both sites, while the other growth regulator, Cycocel Extra, did not.

The problems of short growing season, delayed maturity, and insufficient rainfall are obviously a severe limit to the adaptability of these practices in

Saskatchewan. While it is premature to generalize from one year's data, the use of growth regulators on wheat does not appear economically feasible without a high expectation of lodging. Similarly, extensive knowledge of potential disease losses is required before fungicides can be economically effective.

REFERENCES

Zadoks, J.C., Chang, T.T. and Konzak, C.F. 1974. A decimal code for the growth stages of cereals. Weed Res. 14: 415-421.